Assessing the effectiveness of surrogates for conserving biodiversity in the Port Stephens-Great Lakes Marine Park

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Certificate of Original Authorship

I certify that the work in this thesis has not been previously submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text. I also certify that the thesis has been written by me. Any help that I have received in my research work and preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used as indicated in the thesis.

Signature of Student:

Date:

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Abstract

The effectiveness of marine protected areas (MPAs) in conserving biodiversity depends, in part, on which areas are chosen for protection and how these areas represent the true biodiversity of the planning region. Advances in acoustic technology have enabled high resolution maps of seabed habitats to create habitat maps based on depth and sea bed characteristics, which is quicker and cheaper than sampling biota over similar spatial extents. These habitat classification schemes are often used as surrogates of biodiversity for fish and benthic assemblages in the absence of biodiversity inventories, to depict spatial variation in biodiversity and support conservation planning. However, the intra-habitat variability and precision of these biodiversity surrogates is largely unknown.

The aim of this thesis is to assess the effectiveness of habitat classification schemes as surrogates for biodiversity conservation in Port Stephens-Great Lakes Marine Park (PSGLMP). Fishes were sampled with baited remote underwater video stations (BRUVS) and sessile benthic assemblages were surveyed using an Autonomous Underwater Vehicle (AUV). The results of this study indicate that habitat mapping based on depth is a suitable surrogate for biodiversity of fish assemblages in unvegetated, unconsolidated habitats. Habitat mapping based on depth only categories is not a suitable surrogate for biodiversity of rocky reef sessile benthic assemblages, nor fish assemblages in sponge-dominated reef habitat. Multiple samples of sessile benthic assemblages and fish assemblages from a range of locations subject to differing environmental influences are required to adequately conserve representative samples of biodiversity within the PSGLMP. In the context of MPA planning, sessile benthic assemblages are not a suitable surrogate for biodiversity of fish assemblages. An examination of scales of autocorrelation in sessile benthic assemblages indicates a significant positive correlation between distance and dissimilarity, meaning that assemblages become more dissimilar as distance increases. Biodiversity sampling in this habitat is required at a fine scale (25 m) for the purposes of creating habitat maps for MPA planning.

The results of this study have important consequences for future MPA planning, indicating that representative samples of rocky reef fish and sessile benthic assemblages from a variety of locations within differing environmental domains are required to adequately conserve representative samples of biodiversity. More studies are required to effectively understand what additional information needs to be incorporated into habitat classification schemes so

that they can act as a surrogate for biodiversity for the range of assemblages conserved within PSGLMP.